

ARCHIVED REPORT

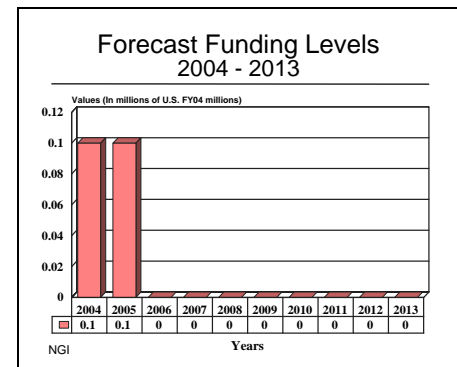
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Next Generation Internet (NGI) - Archived 5/2005

Outlook

- Advanced networking programs now under the Large Scale Networking (LSN) Coordinating Group
- IPv4 Operating Systems transitioning to IPv6 to enable network centric operations
- Full operational capability around year 2006
- Barring a surge in activity, this report will be archived in 2005



Orientation

Description. The goal of the U.S. Next Generation Internet (NGI) effort was to develop technologies that enable networks to scale dramatically in size, speed, and reach, focusing particularly on the capability to accommodate extreme ranges of user demand. The effort was deemed complete by the end of FY2002.

Sponsor

U.S. Department of Defense (DoD)
Defense Advanced Research Projects Agency
(DARPA)
Information Technology Office (ITO)
3701 North Fairfax Drive
Arlington, VA 22203-1714
USA
Tel: +1 703 696 7438
Web site: <http://www.darpa.mil>

U.S. Air Force
Rome Air Development Center
Air Force Research Laboratory
Rome, NY 13441
USA

Status. Initial Operational Capability achieved; advanced research and development continues under various programs.

Total Produced. Not applicable; this is an information management R&D program.

Application. Second Generation (follow-on) Internet for greater data and telecommunications transmissions.

Price Range. Not applicable to R&D effort.

Contractors

Defense Advanced Research Projects Agency, Information Processing Technology Office,
<http://http://www.darpa.mil/ipto/contact.htm>, IPTO, 3701 North Fairfax Drive, Arlington, VA 22203-1714 United States,
Tel: 1 5(711) 218-4336, RDT+E (Next Generation Internet (NGI))

National Institute of Standards & Technology, NIST, <http://www.nist.gov>, 100 Bureau Drive, Stop 3460, Gaithersburg, MD 20899-3460 United States, Tel: 1 (301) 975-6478, RDT+E (Next Generation Internet (NGI))

National Science Foundation, NSF, <http://www.nsf.gov>, 4201 Wilson Blvd, Arlington, VA 22230 United States,

Tel: 1 (703) 292-8070, Fax: 1 (703) 292-9081, RDT+E (Next Generation Internet (NGI))

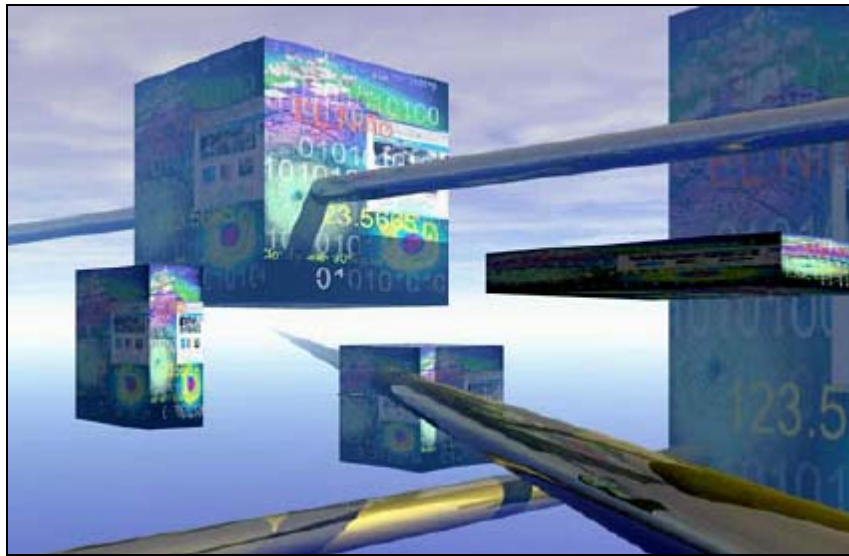
National Aeronautics & Space Administration, NASA, <http://www.nasa.gov>, 300 E Street SW, Washington, DC, 20546-0001
United States, Tel: 1 (202) 358-0000, RDT+E (Next Generation Internet (NGI))

Technical Data

Design Features. The Next Generation Internet (NGI) initiative had three primary goals: first, to promote experimentation with the next generation of networking technologies; second, to connect universities and national laboratories with high-speed networks that are 100 to 1,000 times faster than today's Internet; and third, to demonstrate revolutionary applications that meet important national goals and missions.

The principal agencies involved in this initiative were DARPA, NSF, NIST, and NASA. These agencies

shared in funding this research and development effort. The DARPA activity was aimed at part of the first two goals. DARPA demonstrated end-to-end network connectivity at one-plus gigabits per second for 10 or more NGI sites. The network technologies addressed included multi-gigabit broadband networks, guaranteed quality of service mechanisms, and integrated network management. These technologies were demonstrated in an NGI-developed testbed environment.



Next Generation Internet

Source: U.S. National Oceanic and Atmospheric Administration (NOAA), Office of High Performance Computing and Communications (HPCC)

Variants/Upgrades

This entire project was in itself an upgrade effort to develop a Next Generation Internet.

Program Review

Background. Launched in FY98, the U.S. Department of Defense's (DoD) NGI program kicked off with the design and implementation of the NGI testbed. Other first-year work focused on creating ultra-high-bandwidth Wavelength Division Multiplexed (WDM) connections for the NGI testbed known as SuperNet. Quality of service architecture and initial operating systems services were also developed.

The program agenda for FY99 called for implementing 10-gigabit-per-second, multi-wave, optically switched WDM technology in the NGI testbed; implementing an alpha-level prototype high-speed optical multiplexor; developing an Internet Protocol (IP)/WDM protocol structure; expanding the testbed to laboratories supported by the Department of Defense and to 10-gigabit-per-second links; implementing prototype components of the network monitoring and management system; defining application program interfaces for

information management and collaborative applications; executing congressionally mandated partnerships between Department of Defense Major Shared Resource Centers and centers with supercomputers purchased with DoD RDT&E funds; and executing congressionally mandated regional partnerships for revolutionary applications.

FY00 efforts focused on the following: implementing variable-rate-access technologies and prototypes of distributed optical switching capability compatible with the 100-gigabit-per-second optical network; eliminating two layers of telecommunications infrastructure; developing network planning and simulation technology to meet the requirements of NGI-scale networks; demonstrating real-time (500-msec response) monitoring and control of network resources at all levels; completing the interconnection of SuperNet testbed components and software with 2.5 gigabit-per-second access architecture, up to 10-gigabit-per-second backbone, and with 100-gigabit-per-second distributed switching capacity; and demonstrating the information management and collaborative applications operating over the NGI testbed.

Originally, the program was scheduled to be completed by the end of FY00; however, DARPA decided to extend development by an additional year to ensure an orderly transition to private sector support and to demonstrate the military utility of NGI-development technology. Efforts during FY01 concentrated on finishing the development of the architectural framework for ensuring maximum end-to-end system survivability; developing prototyping tools for assessing

the dependence of applications or networking performance on physical layer resources; and developing specifications for a robust heterogeneous network architecture that integrates gigabit wireless, wireline, and satellite communications.

The main R&D elements of NGI were reportedly completed by the end of 2001. Federal agencies are coordinating advanced networking research programs under the Large Scale Networking (LSN) coordinating group. Additionally, the NGI program reportedly met all of its goals except implementation of the Terabit-per-second networking, which is expected to be implemented under the current LSN research efforts. Although all NGI development funding had been fully allocated by the end of FY2002, money will probably still be needed to overcome glitches in the system. Future funding will likely come from various programs using NGI and its protocol.

The IPv6 transitions went into effect in 2003. The new Internet Protocol known as IPv6 is designed to facilitate integration of the essential elements of the DoD's Global Information Grid with all its sensors, weapons, platforms, information, and people. This step will bring the DoD closer to its goal of network centric warfare. IPv4, the Internet's current operating system, has been in use by the DoD for almost 30 years. Its fundamental limitations, along with the worldwide explosion of Internet use, inhibit network centric operations. In October 2003 the DoD instituted a policy that requires all network capabilities purchased by the DoD to be IPv6-capable, as well as operable with the department's currently extensive IPv4 installed base.

Funding

No further funding is believed to have been allocated. Minor funding may be allocated at the last minute or through other programs using the NGI.

Recent Contracts

No recent contracts valued over US\$5 million have been identified. Some contracts may be issued under various programs using the NGI.

Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
	FY98	Program start
	FY99	Implementation of 10-gigabit-per-second WDM technology
	FY00	SuperNet interconnection testbed complete
	FY01	Program extended one year for transition to private sector support
Dec	2001	NGI development complete
	FY02	Terabit per second networking goal shifted to Large Scale Networking Coordinating Group
Oct	2003	All new network capabilities must now be operable with current IPv4 systems and

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
	2006	IPv6-capable for the future NGI full operational capability scheduled

Worldwide Distribution

This effort was led by the **U.S. Department of Defense**. The Next Generation Internet/SuperNet will be shared with many research universities, corporations, and friendly nations, as well as the many services and agencies within the DoD.

Forecast Rationale

The U.S. Department of Defense's Next Generation Internet (NGI) effort to enable network centric warfare operations has pretty much been completed. The remaining work is now focusing on transitioning the Internet's operating system from IPv4 to IPv6, which allows for better networking. Due to the huge number

of components involved in the NGI (projects, networks, subroutines), one can expect some form of funding to be pumped into the system, though it might not appear under the main NGI program element umbrella.

Barring a sudden increase in activity, this report will be archived next year.

Ten-Year Outlook

Designation	Application	Thru 03	<u>High Confidence Level</u>				<u>Good Confidence Level</u>				<u>Speculative</u>			Total 04-13
			04	05	06	07	08	09	10	11	12	13		
NGI	INTERNET (U.S. DOD/DARPA)	139.744	0.100	0.100	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.200